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The Potentiation of Coccidiostatic Drugs by Pyrimethamine

BY
S. B. KENDALL and L. P. JOYNER
Ministry of Agriculture Veterinary Laboratory, Weybridge

THE marked synergism between pyrimethamine* and certain sulphonamides used in the control of *Eimeria tenella* was originally described by Lux (1954), and was further investigated by Joyner & Kendall (1955) and Kendall & Joyner (1955).

Under experimental conditions pyrimethamine and sulphadimidine† in combination were strikingly successful in reducing mortality from caecal coccidiosis, and it was considered that the use of such drugs in synergistic combination was likely to lead to marked advances in the chemotherapy of *E. tenella*.

At Weybridge, a programme of research was designed accordingly in order to establish effective means for the control of coccidiosis under field conditions. As an initial measure it was decided to test the effect of pyrimethamine in combination with several drugs already in common use for the control of coccidiosis. This paper reports the coccidiostatic activity of sulphadimidine, sulphaquinoxaline, sulphaguanidine and nitrofurazone in combination with pyrimethamine.

Materials and Methods

In order to test the coccidiostatic effect of different combinations of drugs, young chickens, previously isolated as far as possible from the risk of adventitious infection, were inoculated orally with the oocysts of *E. tenella* in numbers sufficient to cause a high rate of mortality among untreated birds. The appropriate drugs were mixed mechanically into the food (a proprietary chick mash), treatment being commenced on the second day following the day of infection and terminating on the fifth day by which time birds in untreated groups were in the final stages of disease. The birds were maintained throughout the observation in wire-floored electrically heated brooders. The success of treatment was judged solely by the rate of mortality compared with that which occurred in groups of untreated birds. Groups of 15 to 21 chicks were used on each occasion. In an initial series of observations, the effect of sulphadimidine, sulphaquinoxaline, sulphaguanidine or nitrofurazone, used at or above the concentration ordinarily recommended under field conditions, was compared with that observed when each drug was used at one-tenth of the initial concentration but in combination with pyrimethamine used at a concentration in the food of 0.004 per cent.

*Daraprim.
†Sulphamezathine.

Results

In the first series of observations (recorded in Table I) all four drugs, sulphadimidine, sulphaquinoxaline, sulphaguanidine and nitrofurazone were shown to have a considerable coccidiostatic effect.

It will be seen (group 1) that sulphadimidine (at a concentration of 0.4 per cent. of the food) was fully effective in preventing deaths from coccidiosis when 73.7 per cent. of the untreated birds (group 9) died. With sulphaquinoxaline (0.08 per cent.) or nitrofurazone (0.024 per cent.) a rate of mortality of 13.4 per cent. occurred. With 2.0 per cent. sulphaguanidine 20.1 per cent. of the birds died. Under these conditions, therefore, sulphadimidine was markedly more effective than the other drugs.

When, however, the concentration of the drugs was reduced to one-tenth of that initially used, both sulphaquinoxaline (group 6) and sulphaguanidine (group 8) in combination with pyrimethamine, were as effective as at the high concentrations, whereas with sulphadimidine (group 5) 26.8 per cent. of the birds died. Nitrofurazone (0.0024 per cent., in conjunction with 0.004 per cent. pyrimethamine), appeared to have no significant effect on the rate of mortality, 67.0 per cent. of the chicks dying as compared with 73.7 per cent. of the untreated chicks.

TABLE I

COMPARING THE COCCIDIOSTATIC ACTIVITY OF HIGH CONCENTRATIONS OF SULPHADIMIDINE, SULPHAQUINOXALINE, SULPHAGUANIDINE AND NITROFURAZONE WITH 1/10 OF THESE CONCENTRATIONS IN COMBINATION WITH 0·004 PER CENT. PYRIMETHAMINE

Group	Treatment All drugs in the food	Percentage rate of mortality
1	0·4 per cent. sulphadimidine	0
2	0·08 „ „ sulphaquinoxaline	13·4
3	0·024 „ „ nitrofurazone	13·4
4	2·0 „ „ sulphaguanidine	20·1
5	0·04 „ „ sulphadimidine + 0·004 „ „ pyrimethamine	26·8
6	0·008 „ „ sulphaquinoxaline + 0·004 „ „ pyrimethamine	13·4
7	0·0024 „ „ nitrofurazone + 0·004 „ „ pyrimethamine	67·0
8	0·2 „ „ sulphaguanidine + 0·004 „ „ pyrimethamine	13·4
9	Control (no treatment)	73·7

The observation was repeated (Table II) using different concentrations of sulphadimidine, sulphaquinoxaline and nitrofurazone in conjunction with 0.0025 per cent. pyrimethamine. Again it appeared that whereas the sulphonamides in conjunction with pyrimethamine were highly effective, nitrofurazone under similar circumstances did not significantly alter the rate of mortality.

TABLE II

A COMPARISON OF THE COCCIDIOSTATIC EFFECT OF SULPHADIMIDINE, SULPHAQUINOXALINE AND NITROFURAZONE IN COMBINATION WITH 0·0025 PER CENT. PYRIMETHAMINE

Group	Treatment All drugs in the food	Percentage rate of mortality
1	0·05 per cent. sulphadimidine + 0·0025 „ „ pyrimethamine	0
2	0·01 „ „ sulphaquinoxaline + 0·0025 „ „ pyrimethamine	0
3	0·003 „ „ nitrofurazone + 0·0025 „ „ pyrimethamine	65·0
4	Control	75·0

It was decided to see whether there was any synergism between nitrofurazone and the sulphonamides. Table III shows that nitrofurazone, at concentrations in the food of 0.0025 per cent. or 0.005 per cent., together with 0.05 per cent. sulphadimidine, did not significantly affect the rate of mortality.

TABLE III

SHOWING THE FAILURE OF NITROFURAZONE TO EXERT A COCCIDIOSTATIC EFFECT IN COMBINATION WITH SULPHADIMIDINE

Group	Treatment All drugs in the food	Percentage rate of mortality
1	0·1 per cent. sulphadimidine	35·0
2	0·005 „ „ nitrofurazone	75·0
3	0·0025 „ „ nitrofurazone + 0·05 „ „ sulphadimidine	85·0
4	Untreated Control (for Groups 1—3)	81·0
5	0·1 „ „ sulphadimidine	50·0
6	0·01 „ „ nitrofurazone	40·0
7	0·005 „ „ nitrofurazone + 0·05 „ „ sulphadimidine	80·0
8	Untreated Control (for Groups 5–7)	85·0

Discussion

It has been suggested (Joyner & Kendall, 1955) that the synergistic effect on *E. tenella* of pyrimethamine and sulphadimidine can be explained as the effect of two antimetabolites which act sequentially at different stages in the same metabolic pathway, at the points at which para-amino-benzoic acid and folic and folinic acids are concerned. Sulphadimidine is known to act as an antagonist to para-amino-benzoic acid. Pyrimethamine is believed to interfere with the metabolism of folic acid.

Under these circumstances any sulphonamide can be expected to be potentiated by pyrimethamine, and as indicated by Lux (1954) it is possible that some sulphonamides having limited or no effect by themselves, may become much more effective in combination.

The results recorded in Table I suggest that, in combination with 0.004 per cent. pyrimethamine, the concentration of both sulphaquinoxaline (a highly active coccidiostatic drug) and sulphaguanidine (a relatively ineffective drug) can be reduced to one-tenth the concentration while producing approximately their original effect.

In earlier work (Kendall & Joyner, 1955) the synergistic combination of sulphadimidine and pyrimethamine was shown to be highly active against *E. tenella*. Under the particular circumstances of the experiment recorded in Table I it did not appear that sulphadimidine was as readily potentiated as were the other sulphonamides. It will be seen, however, (Table II) that a far more satisfactory effect was observed when the concentration of sulphadimidine was increased to 0.05 per cent., while that of pyrimethamine was reduced to 0.0025 per cent. Under these circumstances there was complete protection against a level of infection which caused 75 per cent. mortality among untreated birds. It seems possible that, for full therapeutic control, the concentration of sulphadimidine should not be reduced below 0.05 per cent. in the food. Clearly there is a wide range of different concentrations of pyrimethamine and sul-

phonamides which can be used to provide satisfactory therapy. During an earlier part of this work (Kendall & Joyner, 1955) a series of assays to determine the doses of pyrimethamine necessary to protect 50 per cent. of infected chicks receiving, simultaneously, known subeffective doses of sulphadimidine was recorded and the 50 per cent. protection points were plotted to indicate the "potentiation curve."

This work needs to be extended to indicate the concentrations required to give full protection against the massive infection with *E. tenella* likely to be encountered under epidemic conditions in the field.

The failure of nitrofurazone to produce a satisfactory coccidiostatic effect either in combination with sulphonamide or with pyrimethamine is of great theoretical, as well as practical, interest. If nitrofurazone were an inhibitor similar to pyrimethamine it might be expected to act synergistically with a sulphonamide. If, on the contrary, it produced its coccidiostatic effect by inhibiting para-amino-benzoic acid then it should act in synergistic combination with pyrimethamine. Under the conditions of our experiments, neither of these effects was observed, so that the mode of action of nitrofurazone as a coccidiostatic drug remains in doubt.

From the practical point of view the investigation of the synergism between pyrimethamine and the sulphonamides is of the greatest importance indicating, as it does, the likelihood that therapeutic control will, in the future, be attained by the use of far smaller quantities of drugs. In the past, the sulphonamides, particularly sulphadimidine, have proved most generally satisfactory for field use, but full therapeutic concentrations have been near the toxic limit and have at the best caused some degree of inappetence.

Summary

1. In the control of *E. tenella*, marked synergism has been shown to occur between pyrimethamine and the sulphonamides—sulphadimidine, sulphaguanidine and sulphaquinoxaline, given in the food to experimentally infected chicks.

2. In the presence of 0.0025 per cent. pyrimethamine, 0.05 per cent. sulphadimidine or 0.01 per cent. sulphaquinoxaline in the food completely protected chicks against infection which produced 75 per cent. mortality among untreated birds. By contrast, 0.003 per cent. nitrofurazone, together with 0.0025 pyrimethamine, produced no effect.

3. The apparent absence of synergism between nitrofurazone and either sulphadimidine or pyrimethamine suggests that nitrofurazone exerts its coccidiostatic effect by some mechanism not directly related to the para-amino-benzoic acid—folic acid metabolic chain.

Acknowledgments.—Acknowledgments are due to Messrs. Burroughs Wellcome and Company for a gift of pyrimethamine.

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Occurrence of *Clostridium sordellii* in Great Britain

BY

M. ELIZABETH BROOKS and M. STERNE
The Wellcome Research Laboratories

AND

R. W. BETTY
Newton Abbot, South Devon

IN 1922 Sordelli isolated a highly toxigenic clostridium, which he named *Bacillus oedematis sporogenes*, from human cases of post-operative gas-gangrene. This organism was re-named *Bacillus sordellii* by Hall & Scott (1927) and is usually (Clark & Hall, 1937)—but not unanimously (Tataki & Muet, 1953)—considered to be a toxigenic variety of *Clostridium bifermentans*. *Clostridium sordellii* has since been found associated with a number of different conditions such as post-operative gas-gangrene in man, gas-gangrene in calves following inoculations, and liver infarcts in cattle. Cases in man, cattle and sheep have also occurred where there was no connection with surgical intervention or obvious trauma (Meleney, Humphreys & Carp, 1927; Hall & Gray, 1931; Weinberg, Davesne & Lefranc, 1931; Vawter, 1942). The number of reported occurrences of this infection is small, despite the fact that *Cl. sordellii* produces the most potent of the gas-gangrene toxins.

History of Present Occurrence

One of us (R. W. B.) was called to make a *post-mortem* examination on a heifer which had been found dead three days earlier. The appearances suggested an enterotoxaemic condition and a sample of the intestinal contents was sent to the Wellcome Research Laboratories to be examined for the presence of *Clostridium welchii* toxins. The heifer was one of a herd grazing on marshland near Newton Abbot, South Devon. Five years previously, three heifers had died there. The *post-mortem* appearances resembled those shown by the present case, but no definite diagnosis was made.

Bacteriology

A sterile Seitz-filtered sample of the intestinal contents was found to be very toxic. The intradermal injection of 0.2 ml. of a 1/400 dilution into guinea-pigs elicited a purplish necrotic lesion about 1 cm. in diameter, surrounded by a prominent oedematous area about 4 cm. in diameter. The intradermal injection of amounts equivalent to 0.05 ml. neat filtrate resulted in a necrotic area surrounded by a very extensive oedema which often involved the whole of the lateral and ventral parts of the body wall. Death occurred after about 24 hours. At *post mortem* there was a massive clear gelatinous oedema which almost enveloped the animal. The mucous membrane of the small intestine was often swollen and red and the adrenals prominent and haemorrhagic. Antisera to the toxins of *Cl. welchii* Type A, B, C, D, E, *Cl. septicum*, *Cl. histolyticum*,

Corynebacterium diphtheriae and *Staphylococcus pyogenes* all failed to neutralise the toxicity of the intestinal filtrate.

A sample of the unfiltered intestinal contents was streaked on to blood agar plates, which were incubated aerobically and anaerobically, at 37° C., overnight.

About 30 colonies were picked from these plates into 1 oz. bottles of Robertson's meat broth, which were incubated at 37° C. overnight. The resulting cultures were centrifuged and the supernatant fluids tested intradermally in guinea-pigs. Two supernatants elicited dermal lesions very similar to those produced by the intestinal filtrate. The organisms producing these toxic filtrates closely resembled *Cl. bifermentans*, which suggested that they might be the pathogenic variety of this species, *Cl. sordellii*. Accordingly, filtrates were prepared from meat broth cultures of known *Cl. sordellii* strains and tested in guinea-pigs. The lesions produced were indistinguishable from those produced by the original intestinal filtrate and by supernatants and filtrates of the *Cl. bifermentans*-like organisms isolated from the intestinal contents.

The toxic manifestations of filtrates from all three sources were neutralised by an American *Cl. sordellii* antiserum and by a World Health Organisation standard *Cl. sordellii* antiserum from the State Serum Institute, Copenhagen. No other antiserum had any neutralising effect.

Cultural Characteristics

The strains isolated from the intestinal contents were culturally, morphologically and biochemically similar to strains of *Cl. bifermentans* and *Cl. sordellii* and their appearances agreed with the classical description of *Cl. sordellii*, except that the new isolates failed to produce the opacity on egg-yolk plates which is characteristic of lecithinase producing classical *Cl. sordellii* and *Cl. bifermentans* strains.

The new isolates were identified as *Cl. sordellii* by: (1) their cultural and biochemical characteristics; (2) the similarities of the lesions which their filtrates produced to those produced by filtrates of *Cl. sordellii*; (3) the unique neutralisation of their toxins by *Cl. sordellii* antisera; (4) the conformity of the symptoms provoked in laboratory animals with classical descriptions of *Cl. sordellii* intoxication.

Discussion

Although *Cl. sordellii* produces a very potent toxin it has only been encountered sporadically in cases of gas-gangrene. It is by no means certain that the heifer from which the organisms were isolated died of a *Cl. sordellii* infection, although the high toxicity of the gut contents suggests a serious involvement of the intestinal wall. However, calves dosed with culture filtrate and crude culture showed no ill effects.

It is hoped that this note will draw attention to the possibility of occurrences of *Cl. sordellii* infection. Past experience suggests that this could be associated with inoculation accidents, or with other gas-gangrene infections such as *Cl. chauvoei* (Vawter, 1942).

Displacement of the Abomasum in the Cow

BY

HUGH BEGG and W. A. WHITEFORD,

Strathaven

THE condition to be described is that wherein severe digestive trouble in the cow is related to malposition of the abomasum; the greater part of that organ being abnormally located between the lateral wall of the rumen and the left abdominal wall and incarcerated in that position by the mass of the rumen and its contents.

History

Displacement of the abomasum has only recently been recognised as having a definite clinical entity. The present authors first stumbled on the condition in 1949 (Begg, 1950) and since then have realised that the appreciable frequency of the syndrome may well have accounted for a good many previously undiagnosed illnesses. Other workers have reported on the subject (Ford, 1950; Jones, 1952; Marr & Jarrett, 1955) and a recent excellent publication by American workers at East Lansing, Michigan (Moore *et al.* 1954), focuses attention on the condition.

The authors appreciate that this condition is now fairly widely recognised and present this report merely as a record of the observation of 36 cases covering the years 1949 to 1954.

Aetiology

The cause of this condition is necessarily a matter of conjecture. The American workers quoted, suggest that in late pregnancy the uterus may take up a position ventral to the rumen, displacing it upward and at the same time causing the abomasum to double upon itself so that the freely movable part of that organ is forced into a position at first beneath, and ultimately beyond, the rumen.

The present authors' conclusions are more or less in agreement with this suggestion. The association

Summary

Cl. sordellii and *Cl. sordellii* toxin were identified in the gut contents of a heifer suspected of having died of enterotoxaemia.

Acknowledgments.—We wish to thank Professor A. A. Miles, of the Lister Institute, and Dr. W. L. M. Perry, of the National Institute for Medical Research, for obtaining the *Cl. sordellii* antisera used in our tests.

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with pregnancy cannot be overlooked and it is reasonable to presume that the "lebensraum" demanded by the uterus is the main factor responsible for the abomasum moving to an abnormal situation. Lagerlof (1929) in fact states that in late pregnancy it is usual to find the abomasum displaced to the left.

However, since three only of the authors' 36 cases showed symptoms in late pregnancy, they feel that in the majority of cases where the abomasum has been forced to migrate beyond the rumen, the uterine bulk seems to be able to maintain a degree of equilibrium so permitting normal digestion. It is therefore contended that parturition with the resultant visceral rearrangement is the trigger whereby the weight of the rumen is able to exert its fullest effect on the displaced organ.

Incarcerated in its abnormal position the abomasum becomes markedly dilated and tympanitic and in severe cases may eventually occupy a considerable volume of the left side of the abdomen, extending superiorly to the lumbar vertebrae and posteriorly to the middle of the left flank. The rumen is displaced toward midline and is rotated slightly clockwise. The relative positions of the reticulum and omasum are not appreciably altered. The pyloric extremity of the abomasum remains in its normal site.

Symptoms

Displacement is found to show a definite time relation to parturition. The authors observed three cases showing symptoms from two to one month prior to the expected calving date. Thirty-three cases were observed from as early as 24 hours to as long as four weeks after calving. No instances have been noted in males or virgin females.

In two exceptional cases the illness was severe, one showing severe ruminal tympany, the other concurrent ruminal tympany with colicky pain. In all others observed the illness was of a sub-acute character with vague symptoms. Many cases were reported by owners as being suspicious of acetonaemia; indeed in the recently calved subject a moderate positive Rothera reaction is the rule. This reaction, however, disappears after giving anti-ketone treatment although the illness persists.

Pulse rate, temperature and respiration are within normal limits and the blood-picture is unaltered. The appetite is very poor but there is no tendency, as in acetonaemia, to selective feeding. In very marked contrast to acetonaemia, rumination is greatly depressed.

One of the most notable features of the condition is a "patchiness" or even a marked periodicity of the appetite. One day an affected animal will eat a little of several kinds of foodstuffs; the following day or two practically or even absolutely nothing; the next day appetite may be moderate or even good. Although the phenomenon of appetite in the ruminant is not fully understood, in this condition it does seem that appetite depends to a great extent on the relative degree of fullness of the rumen. It can be readily appreciated that a full rumen must exert a great obstructive effect on abomasal function and only when the rumen is relatively empty is full gastric activity possible. A few hours of near-normal activity sets up a state of affairs where good appetite returns and if the animal has access to food a moderate meal reproduces her discomfort.

Faecal elimination is understandably erratic. Consistency of the faeces is variable but usually normal or slightly soft. No case showed those faecal abnormalities associated invariably with abomasal torsion, and occasionally with traumatic reticulitis.

An affected animal loses substance rapidly but after some time may partly accommodate itself to the unusual digestive situation and eat sufficiently well to keep itself alive although on a very low plane of existence. In no instance, however, has an animal been noted to regain normal appetite and thriftiness as long as a displacement persists.

Diagnosis

Diagnosis of a displacement is made on a consideration of the history in relation to parturition and of the irregularity of the digestive symptoms, but above all by very careful examination of the abdomen with the object of demonstrating the tympanitic abomasum in its abnormal situation. For the sake of clarity this is dealt with in some detail as follows:—

Inspection.—In a large proportion of cases the general appearance of the abdomen when viewed from behind, and from each side of the animal alternately, gives an immediate impression of lop-sidedness. The left abdominal ribs show a greater "spring," the left lower abdomen is full and rounded, while the right lower abdomen is decidedly flat and "tucked-up."

In extreme cases the left sub-lumbar fossa shows a distinct bulge immediately posterior to the last rib. If ruminal movement is normal, and in some cases this may be so, it will be observed that this swelling does not fluctuate with the wave of peristalsis.

Palpation.—Palpation of the left sub-lumbar fossa may show departure from the normal in two respects.

1. The usual intimate contact between the rumen and the whole of the left abdominal wall is difficult to detect.

2. Posterior to the last rib the fossa may show a swelling having a much greater tension than is present in the posterior part of the fossa. The tension of this underlying viscus does not vary with peristalsis in the rumen and in a thin cow this tension may be traceable into the last two or three intercostal spaces.

Percussion.—Percussion of the left abdominal wall produces a variable area of tympanitic resonance bounded posteriorly by the rumen, extending forward until it merges with thoracic resonance and gradually fading downward.

Auscultation.—In a normal animal ruminal sounds may be detected over a large area of the left side, but in an affected animal these sounds are noticeable only in the flank and lower abdomen. Over the posterior ribs there is considerable muffling or even complete absence of ruminal sound. Persistent

listening in this area, up to two or three minutes, may be rewarded by hearing high-pitched tinkling reverberations. These sounds, if noticed, are unmistakable and appear to be produced by movements of gas through abomasal contents, the sounds produced being greatly magnified by the sounding box effect of the large hollow organ.

Rectal Examination.—In two only of the observed cases was the condition verified by rectal examination. In both the rumen had little volume, and the left hand was able to pass over the rumen and palpate with the finger-tips a markedly tense and tympanitic viscus superior and lateral to a rumen showing the usual doughy consistency. In some instances rectal examination is a guide by showing a fairly large rumen well over to the right side when that organ is difficult to palpate in the flank. The authors, incidentally, do not recognise the " negative pressure " finding as described by Hebeler (1954).

To summarise, in a clear-cut case the abnormally placed abomasum is readily demonstrable. In some subjects, however, the clinician may require several examinations of a suspected case before being able to arrive at a diagnosis. Laparotomy will of course show the state of affairs, but in the authors' opinion this course should not be adopted unless other measures fail or unless surgical replacement is intended.

Differential Diagnosis

Displacement of the abomasum is distinguished from acetonaemia by the rapid disappearance of ketone excretion, after treatment by glucose, etc., without improvement in the animal's appetite.

Sub-acute traumatic peritonitis may sometimes resemble this condition but the blood picture invariably indicates the presence or otherwise of a septic focus.

Torsion of the abomasum is unlikely to be confused with displacement. The former condition is usually a severe illness with great systemic disturbance and a tympanitic abomasum is demonstrable in the right side of the abomasum.

Post-Mortem Findings

The authors have yet to see a case which ended fatally due to a displacement *per se*. It is worthy of note, however, that unless one is actually present at the abattoir when an affected animal is being killed and dressed the condition may easily escape notice. In a typical case the butcher's abdominal incision produces a grossly enlarged and tympanitic abomasum on his left with a rumen on his right instead of *vice-versa*. The size of the abomasum may approach that of the rumen, but apart from the hypertrophy pathological changes are absent. One might expect peritoneal adhesions but so far the authors have not encountered anything abnormal which might prevent the abomasum going to its proper place.

Treatment

In the authors' experience, treatment has been rather unsatisfactory. Several courses are available.

1. Starvation. When it is considered that there are no adhesions and no obstacle to replacement of the organ beyond the pressure of the rumen and its contents, it seems reasonable to presume that emptying the rumen by withholding food and water for a sufficiently long period to do this would produce the desired result. Early experiences of such a procedure seemed promising with two cases responding by these measures alone. Unfortunately the withholding of food, and more so fluid, so reduces the vitality of most animals that before the rumen is sufficiently empty to allow the abomasum to replace itself an animal may be at the point of death.

2. Manipulation. Again acting on the evidence of the absence of adhesions, manipulative procedures may be adopted as follows:—Cast the cow on its left side by Reuff's method and then raise it until it is balanced in a dorsally recumbent position. In this position make a careful examination and locate the abomasum, which organ usually presents itself as a tympanitic bulge near the left costal arch. If, on pommelling and kneading the abdomen, this swelling moves from left to right and remains there, allow the animal to fall slowly on to its left side once more before allowing it to regain its feet. In a well marked case an immediate alteration in the abdominal picture is noted on re-examination. This proceeding may require to be repeated before the desired effect is produced.

If the abdomen is moderately distended due to a full rumen and a tympanitic abomasum, such manipulation may fail to cause reduction and greater success is obtained when the condition has reached that stage where the rumen is partly emptied and the abomasal function partly restored.

Manipulative treatment may of course be greatly assisted by withholding food and water for 36 to 48 hours beforehand but unfortunately one cannot then determine immediately whether or not any good effect has been obtained. This is so because fasting causes the temporary disappearance of all demonstrable symptoms and therefore one is in the dark as to the effect of the treatment until the elapse of anything from two to seven days.

3. Surgical Approach. If direct surgical replacement is intended or if a displaced organ is encountered on laparotomy in the left flank, the abomasum is readily distinguishable. One is tempted to effect immediate forcible replacement. The authors have found this to be extremely difficult and the following steps are advisable:—

(a) Open and evacuate the rumen as far as possible.

(b) *Via* the rumen and reticulum introduce the left hand into the abomasum and endeavour to pull it underneath the rumen.

Alternatively, after emptying the rumen close the wound and push the abomasum underneath the rumen.

A résumé of the authors' experiences of treatment may be enlightening. It is certainly not impressive. Of the 36 cases observed, two recovered by starving alone; 17 after manipulating when cast or by starving before casting. Only five cases were operated on, two of which were unsuspected until laparotomy. All operated cases gave a good response initially but

See Correction - v. 69 - p. 516

Current Literature

ABSTRACTS

Possible Infection of Man by Indirect Transmission of Trichophyton Discoides. WALKER, JACQUELINE. (1955). *Brit. Med. J.* December 10th, 1955. 1430-1431.

In many instances infection with ringworm in man can be traced to contact with an animal, usually a calf, suffering from ringworm, occasionally to contact with another human being; but in a significantly large number of cases there is no history of any direct contact with the disease. In such cases it has been assumed that the infection was transmitted in an indirect way by contact with infective hair, scales, or crusts deposited from animals on the ground, on the woodwork of cattle stalls, on scratching posts, and elsewhere. However, in support of this hypothesis little if any material evidence has been adduced.

Material for examination was obtained from three farms in Northern Ireland, one in Hertfordshire and one in Cornwall, on all of which active cattle ringworm existed. The material consisted of scrapings from the walls of seven cowsheds, from five cattle stalls, nine field scratching posts, samples of soil from the base of these nine posts, one fence rail, bark from two trees rubbed by cattle and eight samples of cow dung. All the specimens were examined in microscopic mounts for the presence of infected hair or scales and selected portions were then plated out for culture.

Excluding the samples of cow dung, which yielded entirely negative results, hairs or epithelial scales were found in all but two of the specimens and characteristically infected hairs were seen in two specimens—one from a scratching post and the other from soil at the base of the post. *T. discoides* was isolated in culture from these two specimens and also from a scraping of the wall of a cowshed.

During the course of this study an instance of prolonged survival of the fungus came to light. A herd of Jersey cows, apparently free from infection, was introduced into a new pasture that had not been grazed for two years; there were scratching posts in the field. Two weeks later several of the animals developed ringworm and *T. discoides* was isolated from them.

In view of this observation, tests for survival time were made on 50 samples of *T. discoides* in infected hairs. These samples protected in folded papers were stored at laboratory temperature and examined at intervals for viability. All 50 were found viable at the end of six months, 49 at the end of nine months, 38 at the end of 12 months and 29 at the end of 15 months. It seems probable therefore that under natural conditions some of the dormant parasitic spores, protected in cracks or fissures in bark or woodwork, would have an equally long survival period.

The possibility that the fungus may be able to survive in nature in a saprophytic form was also investigated. Tests were made of the capacity of the fungus to vegetate on soil and other natural substrata. The materials used were the top soil from a chicken-run, soil from a mole-hill, soil from a river-bank, light top soil over chalk, light top soil over gravel, marl over chalk, cultivated garden soil and cow dung. After one week an initial growth was demonstrable in all the materials, but no further development occurred except on the mole-hill and the chicken-run soils and on the cow dung. On the chicken-run soil the ultimate growth was poor, on the mole-hill soil the ultimate growth was rather better, but in the cow dung there developed a colony with a white duvet, which on microscopical examination showed numerous microconidia and some macroconidia.

It seems possible that the results obtained with these three materials may have been due to the presence of animal excretion.

G. F. B.

Persistent Fungus Infections of Skin, Hair and Nails. BARLOW, A. J. E., & CHATTAWAY, F. W. (1955). *Lancet*, December 17th, 1955. 1269-1271.

The dermatophytes form a large heterogeneous group probably derived from soil fungi, which are very adaptable to parasitism on man and animals. From a clinical point of view two distinct groups seem to emerge: in one the main attack is in the hair follicle, in the other the attack is essentially on the horny layer. Normally a species keeps to its particular pattern of attack, but there may be a very wide variation within a species. Species which are normally parasitic on an animal have the ability to invade a hair follicle, and when they attack man invade the hair follicles whether on smooth or hairy skin. Thus the zoophilic organisms *Microsporum canis*, *Trichophyton discoides*, and *Trichophyton mentagrophytes*, in all of which the host-parasite relationship is unstable, invade the follicles and cause inflammation in man.

T. mentagrophytes seems occasionally able to adapt itself to man more completely, but in doing so it apparently loses the ability to invade the hair follicles and becomes the cause of *tinea pedis* possibly with infection of the nails. No variants of this type seem to have been attributed to *T. discoides* or *M. canis* and the former may at least retain its virulence for its normal host after long periods in artificial culture.

The host offers to the parasite, as a medium for growth, a thin sheet of soft keratin dipping down in the hair follicles to ensheathe a shaft of hard keratin

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none regained normal health. Of the remaining 12, three were sent for slaughter on diagnosis leaving nine cases which failed to respond to repeated manipulations.

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and a keratogenous zone beyond. Most observers state that the fungi can grow only in the fully keratinised tissues and that the keratogenous zone is never invaded. Unfortunately there are no accurate observations on this, and it is difficult to be dogmatic about the exact point at which hard keratinisation in the hair follicle is complete.

There is evidence that the dermatophytes can live saprophytically on the skin without producing any visible signs of their presence. Once, however, pathogenic invasion has taken place, the clinical picture is ascribable to two main factors: (1) damage to the fabric of the skin, hair and nails which the fungus causes by its growth through it including scaling, lustreless, and broken hair and nails; and (2) the host's reaction, including both epidermal and follicular inflammation as well as various eczematous reactions and hyperkeratosis of the affected areas.

Inflammation essentially due to follicular infection and potentially curative is the rule with zoophilic fungi but may develop with any fungus which invades the follicles, and has been described in infection with most of the anthropophilic fungi.

Hyperkeratosis of the palm or sole, where corresponding nails are affected, not only is not curative but also predisposes to chronicity, since it provides a medium in which the fungus may vegetate and through which topically applied fungicides cannot penetrate. There is thus a contrast between the curability of ringworm due to zoophilic fungi and the relative resistance to treatment of ringworm due to anthropophilic fungi.

In the woollen industry much work has been done on the structure of keratin and the action of keratin—degrading agents. Many of the degrading agents used in commerce are too toxic to apply to patients' skin. But degrading agents such as lithium bromide and urea do permit the penetration of fungicides. Keratin-degrading agents used by themselves facilitate the penetration of fungi, and should not be used by themselves, but used in conjunction with fungicides may facilitate treatment.

A brief description is given of a trial, in five patients, with resistant *T. rubrum* infection of the feet, of a combination of fungicides and urea. The results were encouraging.

The work underlines the need for a closer study of the barrier presented by keratin to the penetration of fungicidal agents into the deeper layers of the epidermis and into the lower two-thirds of the hair follicles.

G. F. B.

News and Comment

THE QUEEN INSPECTS TRYPANOSOMIASIS RESEARCH INSTITUTE

It is reported from Kaduna that the Queen and the Duke of Edinburgh have paid a visit to the West African institute for trypanosomiasis research during their tour of Nigeria. Dr. James Williamson, the research biochemist at the institute, spoke of the development of a new method of activating drugs to increase the resistance of cattle and other domestic animals to disease. The process makes the drugs less soluble and also less toxic, so that bigger doses can safely be given.

Dr. R. S. Desowitz, the officer in charge of the veterinary section, said that experiments had been conducted on zebu cattle at the institute stock farm at Vom. Two drugs had shown great promise, and there might be in sight the practicability of keeping cattle in the worst tsetse areas.

The Queen and the Duke of Edinburgh spent some time touring the laboratories, and saw the fly room where tsetse used in experiments are reared.

PUBLICATION OF "THE RECORD"

Readers will have learned from the daily press that the difficulties in the printing trade have now reached a critical stage. This week we are able to produce an issue reduced in size to 32 pages, but at the time of writing the future position is obscure. The Editor would be grateful if correspondence intended for publication, and classified advertisements, could be confined to *essential* material only, and every effort will be made to see that at least token issues of THE RECORD, in whatever form, continue to be circulated.

PRESENTATION TO MR. J. D. FERGUSON

A presentation, subscribed by local farmers and members of the general public in and around Crieff, was made recently to Mr. J. D. Ferguson on his retirement from practice. He had been a veterinary surgeon in the locality for some 30 years. A presentation was made at the same time to Mrs. Ferguson. Mr. J. Lambie presided over the gathering, and Mr. James F. Strang presented the gifts which comprised a cine projector, an inscribed pair of binoculars and a necklace. Tributes were paid by leading members of the community to the skilful and conscientious professional services through which Mr. Ferguson had laid owners of animals in his debt over so many years.

THE B.R.X. CLUB

The annual dinner of the B.R.X. Club is to be held at the Royal Veterinary College on Saturday, April 7th. Professor T. J. Bosworth will be the guest of honour and the President, Professor C. W. Ottaway will be in the chair. This is the 10th anniversary of the Club; arrangements are being made to celebrate the occasion in a suitable way. Members should receive their formal invitations by the first week in March. Anyone who has been missed out is asked to write to the Secretary if he wishes to come. The address is:—A. S. King, Hon. Secretary B.R.X. Club, Department of Veterinary Anatomy, University of Bristol, Bristol, 8.

IN PARLIAMENT

Slaughter of Animals

Mr. E. Johnson asked the Minister of Agriculture, Fisheries and Food on how many occasions in 1955 veterinary officers of his Department visited slaughterhouses or knackers yards at which horses were being slaughtered; whether in all cases the provisions of the Slaughter of Animals (Amendment) Act, 1954, were being fully complied with; and what action was taken in regard to infringements of that Act.

Mr. Amory: Such visits were made by officers of my Department on 54 occasions. In a number of cases the provisions of the Regulations made under the Act were not being fully complied with, and the infringements were brought to the notice of the local authorities responsible.

Mr. E. Johnson asked the Minister of Agriculture, Fisheries and Food if he is aware of the concern which is widely felt because the electric stunning of pigs is often incorrectly carried out; and if he will take steps to ensure greater supervision, proper training of slaughtermen, the installation of a voltmeter in all slaughterhouses where pigs are electrically stunned and the provision of smaller enclosures so that pigs cannot run about before being stunned.

Mr Amory: I am not aware of any general concern about this matter; but I am anxious to do all I can to ensure humane slaughtering, and I will consider my hon. Friend's suggestions with this in mind.

Mr. Johnson: May I ask my right hon. Friend whether he is aware that in some cases the tongs by which this stunning is carried out are applied in the wrong place—behind the pig's ear instead of in front of it—with the result that the pig is paralysed but not stunned, and though it cannot move, it can feel pain? Will my right .hon. Friend look into this matter?

Mr. Amory: I have had no representations made to me on this point, but I will bear in mind what has been said by my hon. Friend and make inquiries.

Fowl Typhoid

Mrs. White asked the Minister of Agriculture, Fisheries and Food what steps are being taken to deal with fowl typhoid, which is causing losses to farmers in Wales and certain other parts of the country.

Mr. Amory: My veterinary officers have been carrying out an investigation into this disease to obtain more information about its behaviour and control and to study the possibility of using a vaccine. So far, vaccination has given disappointing results but encouraging progress has been made with a drug which can be added to the food. Further trials are in progress. Research into other methods of controlling the disease is being conducted at my Department's veterinary laboratories.

Mrs. White: Is the Minister aware that this disease is spreading very rapidly indeed in parts of Flintshire and adjacent areas of Cheshire and Shropshire and that more than 16,000 birds were affected in one district in Flintshire alone last year? Will he make it a notifiable disease, because if that is not done, there is no control on the movement of diseased birds?

Mr. Amory: I will certainly take into consideration what the hon. Lady says, but there are difficulties in making it a notifiable disease, because the symptoms, I am advised, are extremely difficult to recognise. However, I am anxious about the situation, and I will do everything I can to assist.

CRUFTS

The chief veterinary officer for Crufts Dog Show, Mr. S. F. J. Hodgman, has commented favourably upon the excellent amenities for the veterinarians provided again this year by the Shows' Regulation Committee of the Kennel Club. In all, 12 veterinary surgeons accepted Mr. Hodgman's invitation to act, and a record entry of 6,433 dogs of more than 100 different breeds kept them fully occupied.

They were assisted by two canine nurses, and were provided by the Kennel Club—the organisers of the Show—with all first-aid and other necessary equipment. As noted in our columns not long ago it is the declared intention of the Club to see that proper amenities are provided for the professional personnel at all their shows.

The Club has expressed its grateful thanks to Mr. Hodgman and his colleagues, and proposes to make donations, in recognition of their services, to the Victoria Veterinary Benevolent Fund, and the National Veterinary Benevolent and Mutual Defence Society.

It is interesting to note the growing importance of the export of pedigree dogs, for which much credit must go to the Kennel Club. In 1947, fewer than 600 dogs were exported. Last year, 3,524 were sent abroad.

COMING EVENTS

February

22nd (Wed.). Second Meeting of the A.V.T. and R.W's. Scottish Regional Group for the 1955-56 session in the Moredun Institute, Edinburgh, 2.15 p.m.

23rd (Thurs.). Meeting of the Essex Division, B.V.A., at the Essex Institute of Agriculture, Writtle, 7.30 p.m.

Spring Meeting of the Dumfries and Galloway Division, B.V.A., in the Crown and Mitre Hotel, Carlisle, 2.15 p.m.

24th (Fri.). Annual General Meeting of the Royal Counties Division, B.V.A., at Caversham Bridge Hotel, Reading, 2.30 p.m.

29th (Wed.). 94th Annual General Meeting of the Lancashire Division, B.V.A., in the University Veterinary Hospital, Liverpool, 2.30 p.m.

Meeting of the West of Scotland Division, B.V.A., in the Glasgow University Veterinary Hospital, Bearsden Road, Bearsden, 2.30 p.m.

Dinner Dance of the Sussex Veterinary Division, B.V.A., in the Adelphi Hotel, Brighton, 7 p.m.

March

1st (Thurs.). General Meeting of the Central Division, B.V.A., at the Royal Veterinary College, Camden Town, N.W.1., 6 p.m.

2nd (Fri.). Annual General Meeting of the South Wales Division, B.V.A., at the Dolwar Café, Carmarthen, 2.30 p.m.

7th (Wed.). Annual General Meeting of the Scottish Metropolitan Division, B.V.A., at the Royal (Dick) School of Veterinary Studies, 3 p.m.

Annual General Meeting of the A.V.T. & R.W's. (Northern Region) at the Veterinary Hospital, Liverpool, 2 p.m.

8th (Thurs.). Annual General Meeting of the Midland Counties Division, B.V.A., in Birmingham.

Annual General Meeting of the Midland Counties Division, B.V.A., at the Birmingham Medical Institute, 154, Great Charles Street, Birmingham, 2.30 p.m.

16th (Fri.). The Victoria Veterinary Benevolent Fund Ladies' Guild Dance at the Luncheon Club, Ministry of Agriculture, Tolworth, 8 p.m.

22nd (Thurs.). Spring Meeting of the North of Scotland Division, B.V.A., at the Northern Hotel, Aberdeen, 2.30 p.m.

27th (Tues.). General Meeting of the Society of Practising Veterinary Surgeons, B.V.A., at the Department of Veterinary Surgery, Langford, 2.30 p.m.

April

4th, 5th and 6th (Wed., Thurs. and Fri.). B.V.A. Council and Committee Meetings, at Royal (Dick) School of Veterinary Studies, Edinburgh.

6th (Fri.). Meeting of the North Wales Division, B.V.A., at Ruthin, 2 p.m.

20th (Fri.). Meeting of the Mid-West Division, B.V.A.

September

16th to 22nd (Sun. to Sat.). 74th B.V.A. Annual Congress at Royal Leamington Spa.

COMMITTEE AND COUNCIL MEETINGS OF THE B.V.A., ROYAL (DICK) SCHOOL OF VETERINARY STUDIES, EDINBURGH

Wednesday, April 4th

10.15 a.m.—Veterinary State Medicine Committee.

2.00 p.m.—Home Appointments Committee.,

4.00 p.m.—Organising Committee.

Thursday, April 5th

10.15 a.m.—Parliamentary and Public Relations Committee.

2.00 p.m.—General Purposes and Finance Committee.

Friday April 6th

10.30 a.m.—Council meeting.

ADDRESSES OF DISEASE INFECTED PREMISES

The list given below indicates, first the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

Anthrax

Ches. Middleshurst Farm, Long Green, Barrow, Chester (Feb. 9).

Clackmannan. Powmill Farm, By Dollar (Feb. 9).

Cumberland. High Crossgill, Garrigill, Alston (Feb. 8).

Durham. Riggside, St. Johns Chapel, Bishop Auckland (Feb. 8).

Leics. Hose Lodge, Hose, Melton Mowbray (Feb. 7).

Lincs. Strubby Hall Farm, Langton, Lincoln (Feb. 7); Elmscroft, Wrangle, Boston; Farm at Boston Road, New York (Feb. 8).

Norfolk. Manor Farm, Castleacre, King's Lynn (Feb. 7); Old Hall Farm, Middleton, King's Lynn; Stennowe Park, Guist, Dereham; Spa Farm, Aylsham, Norwich (Feb. 9).

Rutland. Manor Farm, Langham, Oakham (Feb. 9).

Staffs. Ivy Farm, Donisthorpe, Burton-on-Trent (Feb. 7).

Westmorland. Puss Gill Farm, Dufton, Appleby (Feb. 8).

Yorks. Market Place, South Cave, Brough; The Poplars, Main Street, Brandesburton, Driffield; High Farm, Bilton; Town End Farm, Grantley, Ripon; Strathmore Farm, Baildon, Shipley; Piggeries at Quarry, Crimbles Road, Pudsey, Leeds (Feb. 7); Red House, Main Street, Watton, Driffield; Town Farm, Tunstall, Withernsea; Hill Farm, Marton; Throstle Nest Farm, Otley; Upper Butterthwaite Farm, Butterthwaite Lane, Ecclesfield, Sheffield (Feb. 8); Cringley Farm, Askrigg, Leyburn; Bramley Grange, Bramley, Malton; Granary Farm, Sawdon, Scarborough; South View, Thornton Rust, Leyburn; Home Farm, Yearby, Redcar; Willow Farm, Foggathorpe, Selby; South Lodge Farm, Aberford, Leeds (Feb. 9).

Atrophic Rhinitis

Middlesex. Commerfields Farm, Hollybush Lane, Denham, Uxbridge (Feb. 9).

Fowl Pest

Berks. Knoll Farm, Gipsy Lane, Wokingham (Feb. 8).

Essex. 45, Straight Road, Boxted, Colchester; 36, Straight Road, Boxted, Colchester; 42, Peppers Lane, Straight Road, Boxted, Colchester (Feb. 7).

Herts. Cherry Tree Cottage Hospital, Hemel Hempstead; Cottage Farm, Mayes Lane, Barnet (Feb. 8).

Oxford. Stone Pits Farm, Blackthorn Hill, Bicester (Feb. 8).

Swine Fever

Gloucester. The Harpers, Standish Lane, Moreton Valence (Feb. 10).

Northants. Lodge Farm, Great Oakley, Corby (Feb. 10).

Worcs. Horsehill Farm, Bewdley (Feb. 7).

Yorks. Slaughterhouse, Bright Street, Hull (Feb. 7).

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

Mastitis in Practice—A Brief Survey

Sir,—The following results obtained from bacteriological examination of milk may be of interest. There would appear to be a high incidence of infection with gram-negative organisms, and a number of uncommon organisms were isolated. The samples were obtained from clinical cases of mastitis attended by myself in Worcestershire, over a six-month period beginning in early March of this year. All the milk samples were examined by the staff of the Veterinary Investigation Centre, Langford, Bristol, to whom I am most grateful.

Every untreated case of mastitis attended was sampled, and also some which had had previous treatment, usually penicillin, these accounting for all the negative samples except two. These two were mastitis in a pregnant heifer, and a sudden

severe mastitis in a cow. A rod-shaped organism was found in smears of the latter's milk, but could not be isolated on aerobic or anaerobic culture. When mastitis appeared in a quarter following mastitis elsewhere, *Streptococcus agalactiae* was often found. In some of these "secondary" cases the milk just contained clots, and was negative on culture.

The gram-negative infections resulted in a swollen quarter, a febrile reaction sometimes, and a great variety of changes in the milk. The apparent effect of aureomycin indicated that coliforms and *Bacterium coli* were not always susceptible, though chloramphenicol* was usually effective. One case of interest was a 15-year-old Friesian. This animal had milked normally that morning, yet two hours later the quarter was extremely hard and enlarged, and a watery secretion dripped from the teat. Temperature was 101°. She died within 24 hours, *Bact. coli* being isolated from the secretion of that quarter, and *Str. agalactiae* from another less affected quarter. Numerous serosal ecchymoses were seen *post mortem*, and the affected mammary tissue was "blackened."

Pasteurella septica. This cow was an Ayrshire, calved five months, temperature 101·5°, quarter swollen and painful. The secretion was watery with slimy clots. The infection responded to aureomycin.

Streptococcus zooepidemicus. This was a fifth calver, calved one month, and the quarter had been treated with penicillin for two days. She had a temperature of 107·3°, though the mammary changes were relatively mild. Rapid response was shown to sulphadimidine soluble administered subcutaneously, and intramammary streptomycin. *Str. agalactiae* was isolated from a second quarter in which mastitis had just appeared.

Clostridium welchii, with *Bact. coli*. This seven-year-old Friesian had calved two days, temperature 102·4°. The quarter was swollen, the milk having appeared gassy that morning, and it contained blood and clots, but did not have any particular odour. Intramuscular penicillin and intramammary aureomycin were used in treatment. Apparently the cow became unsteady, and showed swelling around the muzzle that evening but had recovered by the following day. The milk was almost normal after four days, but the quarter later became dry.

Mastitis was observed in six ewes. *Staphylococcus pyogenes* was isolated from four cases, coliforms from one with a yellowish secretion, and a coagulase negative (slide test) haemolytic staphylococcus from the sixth, this latter being the only fatal case. All were treated with intramammary aureomycin. Two sows were sampled, coliforms being isolated in both cases.

MICRO-ORGANISMS ISOLATED FROM MILK IN CASES OF MASTITIS

	All quarters (cows) sampled	Untreated quarters subsequent to mastitis elsewhere	Quarters with persistent clots despite treatment
Str. agalactiae ...	6	3	1
Str. dysgalactiae ...	3	—	—
Str. uberis	1	—	1
Str. zooepidemicus ...	1	—	—
Staph. pyogenes ...	9 (4 cows)	—	1
Coagulase negative haemolytic staphylococcus	1	—	—
Corynebacterium pyogenes	3	—	—
B. coli	4	—	—
B. coli (haemolytic) ...	1	1	—
Coliforms	5	1	—
P. septica	1	—	—
Str. uberis + haemolytic coliform ...	1	—	—
C. pyogenes + *Str. dysgalactiae*	1	—	—
Cl. welchii + *B. coli*...	1	—	—
Negative	18 (15 cows)	5 (4 cows)	5 (3 cows)
Total	56 (48 cows)	10 (9 cows)	8 (6 cows)

Three cases coliform, and one *Bact. coli* infection came from a group of five cows kept together, and all occurred within a period of two weeks.

* Dapsetyn.

Yours faithfully,

LIONEL A. HEMSLEY.

c/o 312, Lower Addiscombe Road,
Croydon,
Surrey.

February 4th, 1956.

A Report Required

Sir,—I am anxious to obtain a copy of the Ministry of Agriculture's Report of the Proceedings under the Diseases of Animals Acts for the year 1931 in order to complete a series for binding for our departmental library and it has not proved possible to obtain this through ordinary channels. If any of your readers could supply a copy which is no longer required I should be most grateful.

Yours faithfully,

A. ROBERTSON (Professor).

Department of Veterinary Hygiene and Preventive Medicine,
Royal (Dick) School of Veterinary Studies,
Edinburgh.

February 14th, 1956.

Endotracheal Intubation of Cattle

Sir,—In the article "Endotracheal Intubation of Cattle" by Messervy & Jones which appeared in THE VETERINARY RECORD of January 14th, 1956, the authors make three statements which in our opinion should not pass without comment.

1. "The induction of general anaesthesia in ruminants, especially cattle, is a major and often dangerous operation owing to the possible inhalation of regurgitated rumen contents or accumulated saliva."

2. "Predisposition to regurgitation also occurs if the stomachs are full, especially if their contents are fluid; it may also occur when the animal falls to the ground during induction."

3. "It is considered that where general anaesthesia is indicated in ruminants it is essential to use an endotracheal tube, primarily to prevent aspiration of food material, and secondly to ensure a free airway."

Whilst we agree that regurgitation does occur from time to time in anaesthetised cattle it does not in our opinion constitute a serious hazard. Since the opening of this Field Station 259 bovines of both sexes and all ages have been subjected to general anaesthesia ranging from light to deep in character. The anaesthetics used have been chloral hydrate intravenously at dosage rates up to 6.5 g. per cwt., with a few at 7 g. per cwt., supplemented where necessary in order to maintain surgical anaesthesia throughout a prolonged operation by chloroform by inhalation in the earlier members of the series and by pentobarbitone sodium intravenously in the later.

In these cases regurgitation of appreciable quantities of ruminal contents occurred only seven times, although slight regurgitation and appreciable salivation occurred in several. In none of the cases quoted has death ascribable to asphyxia or inhalation pneumonia occurred. Death during anaesthesia due to respiratory failure has occurred on three occasions; in none of these did regurgitation occur. In one chloroform was used to augment chloral and in the second pentobarbitone sodium alone was used. In the third, a very sick cow, respiratory failure occurred with chloral alone.

It has never been the practice at this institution to deprive bovines of food or water prior to anaesthesia, nor to induce general anaesthesia in the standing position, as the casting of cattle is a simple, safe and straightforward procedure and greatly facilitates the administration of the chloral hydrate. It is, however, always ensured that the neck of the anaesthetised animal is kept straight, and the head placed as low as possible with the tongue drawn out of the mouth.

In conclusion we feel that general anaesthesia, properly administered to cattle, is both safe and technically straightforward, and may be undertaken with confidence without any necessity for the additional measures suggested by Messervy & Jones.

Yours faithfully,

H. E. RITCHIE,
P. J. N. PINSENT,
P. A. NEAL.

The University of Liverpool,
Faculty of Veterinary Science,
Field Station, "Leahurst,"
Neston.
Wirral.

January 23rd, 1956.

Hydatid Cysts

Sir,—The article on hydatid cysts in a Thoroughbred mare by W. C. Miller & D. Poynter in THE VETERINARY RECORD of January 21st brings to mind a similar case treated in this practice in February, 1954.

The subject was "Monarch," a 10-year-old police horse. We were first called to the horse on February 18th when tetanus was diagnosed. Some response to massive doses of T.A.T. was shown but recovery was never complete. The horse could take fluids and he could move fairly freely in the slings, but the muscles of head and neck never completely relaxed. On February 27th he appeared to relapse and destruction was advised on the following day. *Post mortem* revealed extensive infection of both liver and lungs with a cystic condition which was diagnosed by the veterinary pathology department of Liverpool University as hydatid cysts. We felt, at the time, that had it not been for this condition we should have succeeded in curing the tetanus.

As in the case reported by Messrs. Miller & Poynter, "Monarch" never showed any symptoms of hepatic damage or broken wind. The constable who rode him reported that he never showed distress even at fast paces and always had a healthy appetite. Considering the extent of the damage to both liver and lungs we might have doubted the constable's word had we not known the horse for several years—during most of which time these two organs could have been only partly functioning.

Yours faithfully,

A. J. ADAMS.

Roughwood,
485, Bradford Road,
Thornbury,
Bradford.

January 31st, 1956.

Sir,—With reference to the article by W. C. Miller and D. Poynter on hydatid cysts in the horse, I should like to place on record a case seen recently.

In October, 1955, I attended a seven-year-old hunter gelding for acute colic. The clinical signs suggested torsion of the intestine, which diagnosis was borne out by the subsequent *post-mortem* examination. Torsion of the ileum had occurred about its mesentery.

The interesting feature was that the liver, diaphragm and right kidney were involved in a cystic mass similar to that described by Miller and Poynter. Specimens sent to the Ministry of Agriculture Laboratory at Weybridge were confirmed as fertile hydatid cysts.

The gelding was out of a New Forest mare by a Thoroughbred horse, and as far as I can ascertain was born in the New Forest area. It had been hunted locally here for the past two seasons and appeared to be in very good bodily condition. No previous signs of ill-health had been noticed.

It might be suggested that pain from the cystic lesions caused the animal to roll, with the torsion of the ileum as a sequel.

Yours faithfully,

J. F. HENDERSON.

Hamwood, Burton Hill.
Charminster,
Dorchester,
Dorset.

January 30th, 1956.